"nomes," but also for more than one temple, or important shrine, and its attendant city in many of the "nomes."

The event which induces M. Daressy to publish the fruits of his erudition upon this subject is the publication by him of a bronze zodiac with a series of two rows of twelve figures, the outer zone being the familiar zodiacal signs, and the inner, twelve animal symbols, attributable, Egyptologists think, to the twelve forms or phases assigned to the sun during his twelve hours' journey. These, in the earthly Egyptian gazetteer, are assigned to twelve of the twenty districts of Lower Egypt. This newly found double zodiac is very valuable for the explanation it affords of the symbols of the constellations upon the Denderah zodiac, because all these figures are intermingled in the large central circular disc, mixed up with deity figures representing the planets and certain prominent high-magnitude stars and the decans.

It should be stated that the zodiacs designed, and hitherto found, in Egypt are not of great antiquity. The arrangement of their symbols and of figurative objects for some constellations has certainly been produced under Greek influence. They appear to emanate from the Egyptian priests uniting their old stellar figure mythologies to the astronomical astrology of the Alexandrian school. Both parties, however, must at the date of the composition of these zodiacs have been acquainted with the Chaldean science of the heavens, derivations from which appear in the Old Testament and early Greek classics and art.

The deity symbols upon the Babylonian boundary stones are almost always astral and frequently zodiacal. Since the large increase in number of these monuments found at Susa, we have a much more complete series of the symbols. Thus upon the stele of Melishipak we have the figure of an archer with the upper part human and the lower part that of a double-headed horse and two tails; those of a horse and a scorpion; also wings. This representation agrees almost completely with the Sagittarius of the Denderah zodiac, and with this Sagittarius the scorpion is associated in both cases.

This assimilation of Mesopotamian astronomy is identical with the adoption by the Egyptians of several Babylonian legends of the gods into Egyptian mythology. These exploits were foisted upon the deeds of Egyptian deities. For example, the Izdubar (Hercules) legends were in some cases introduced into the conflicts of Horus.

The parallels between terrestrial Egyptian geography and the places of the stars must, however, have been very old in Egypt, though not anterior to the era of Menes. M. Daressy ingeniously explains the principles upon which these were arranged, and henceforth Egyptologists will trace in the primitive texts allusions to them and decide approximately when they were invented. The favourite constellations other than the zodiac were the circumpolar stars, because they never set and so were symbolic of eternity.

In addition to the famous zodiac from Denderah, now in the Louvre, we have, among others, the new one at Cairo, the planisphere and tableaux carved on the hypostyle hall at Denderah, copies of others once at Esneh and Erment, and the coffin of Hern-netch-tep in the British Museum.

JOSEPH OFFORD.

THE PREVENTION OF COLLISION AT SEA.[1]

PROF. JOLY proposes, in the work before us, that sound, which travels at different rates through different fluids, should be utilised for navigational purposes as well as for the prevention of collision. The rate of travel of sound through air—viz. 1090 ft. per sec. at a temperature of 32° F. (zero C.), or 1100 ft. per sec. at a temperature of 52° F. (11·1 C.)—has long been utilised in H.M. naval surveying service for measuring bases in places where it is not possible to land, owing to the coast being covered with mangrove growth. The system in use is to fire a small mortar which has a plug driven in its muzzle and to note the time which elapses between the flash of the discharge and the report of the mortar. For this purpose a chronometer watch which beats five times for every two seconds of time is used, and it will be evident that each beat of the watch represents 440 ft., so that if the observer makes a mistake in counting the beats a corresponding error will be the result in the length of the base.

This method of ascertaining distance has also been used to ascertain the distance off a cliffy coast when sailing along it. In H.M.S. *Actæon*, when sailing along the coast of Russian Tartary, which has very few distinctive marks, a gun was fired at intervals and the beats of the watch counted until the echo was heard. Half the time elapsed gave the distance off.

In the case of sound travelling through water the rate is much more rapid, and that rate depends on temperature as well as on the density. In river water the rate is 4714 ft. per sec. at a temperature of 55° F. (13° C.), and of 5013 ft. per sec. at a temperature of 86° F. (30° C.), whilst in sea-water, at a temperature of 68° F. (20° C.), its rate is 4761 ft. per sec., but where the specific gravity of the water is increased, as in the Mediterranean or Red Sea, the time will be different. In thick weather, therefore, when the flash of a gun cannot be seen, the distance off can be ascertained by noting the number of beats between the receipt of a sound travelling through water and one through the air, provided they are emitted simultaneously. This difference is 4·25 secs. for each nautical mile the observer is distant from the point where the sound is emitted, or 10·63 beats of the watch per mile.

In a vessel fitted to send or receive radiotelegraphic messages, if a signal be sent simultaneously with the sound signals it is equal to seeing the flash of the gun. If the number of

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[1] "Synchronous Signalling in Navigation." By Prof. J. Joly. Pp. 54. (London: T. Fisher Unwin Ltd., 1916.) Price 3*s*. 6*d*. net.

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beats be counted between the receipt of the radiotelegraphic message and the subsequent reports through the water and the air, the distance can be ascertained and checked, observing that an error of the beat means 440 ft. in air, but in water an error of one beat means an error of 1900 ft.

If sound signals could be implicitly relied on they would be a still greater aid to the seaman than they now are, for they are used at present both in air and water to warn vessels—in air by bells, guns, and sirens, and in water by submarine bells—but, unfortunately, they are not absolutely to be relied on, for experiment has shown that areas of silence occur sometimes in the vicinity of the localities where sound signals are emitted through the air, and that signals emitted through water may be deflected or reflected by obstruction. But further experiments are required before a definite opinion can be pronounced on their accuracy, and especially experiments on the rate of travel of sound through ocean water of different densities and temperatures. Experiments seem also to be needed in crowded thoroughfares as to whether sound-signals are or are not masked by more than one vessel emitting them. In addition, experiments are desirable with reference to the conveyance of sound through the water from shore stations: (1) What means should be taken to send the signal? (2) Will waves beating on the shore, especially on a rocky coast, interfere with the signal?

It is a great advantage to seamen that men of science should direct their attention to investigating problems of this nature, and it is to be hoped that Prof. Joly's work may cause the subject to be taken up and some further experiments made on the points which are still uncertain; but the book as it is is well worthy to be studied by all navigators.

It only remains to point out that it is a simple matter to draw a curve which will tell at a glance the distance from a station emitting simultaneous signals. If the beats of the watch be used as ordinates and tenths of miles as abscissæ, three curves can be drawn, one showing the distance off by the time elapsed between the flash of a gun, or the receipt of a radiotelegraphic signal, and the sound conveyed through the air; another, of the distance off by the time elapsed between the flash of a gun, or the receipt of a radiotelegraphic signal, and the sound conveyed through the water; and a third by the time elapsed between the two sounds, one conveyed by air, and the other by the water.

PROF. T. G. BRODIE, F.R.S.

DEEP regret is felt by many men of science at the death of Prof. Brodie, which occurred suddenly (from heart failure) at the early age of fifty on August 20. He was not only pre-eminent in the scientific world, but had endeared himself in a quite exceptional way to his numerous pupils, colleagues, and friends. The world is indeed poorer by his loss, and the tragic suddenness in being cut off in his prime adds an unusual pathos to the event.

Prof. Brodie was born at Northampton, and was the second son of the Rev. A. Brodie, Vicar of Grandborough. He was educated at King's College School and St. John's College, Cambridge. He received his medical education at King's College, London, and after a brilliant academic career there and taking his degree of M.D. at the London University, he became demonstrator of physiology at his alma mater, and devoted his life thenceforth to this branch of science. He then became in turn senior demonstrator of physiology at the London Hospital and lecturer in the same subject at St. Thomas's Hospital. While still a student he commenced research work, and his earliest paper on Muscular Elasticity still remains authoritative. So closely was his name connected with original research, and so numerous were his papers on both the chemical and physical side of physiology, that when Prof. Sims Woodhead relinquished his directorship of the laboratories of the Royal Colleges of Surgeons and Physicians, London, for his chair at Cambridge, Brodie was immediately chosen as his successor, and he held the post with distinction and success until the Royal Colleges, as a measure of economy, decided to maintain their laboratories no longer. So fruitful had been the work carried out and inspired by Brodie in this position that in 1904 he received his F.R.S. Then came an interval in which Brodie filled simultaneously three posts—namely, the lectureship on physiology at the London School of Medicine for Women, the professorship of physiology at the Royal Veterinary College, and the professor superintendentship of the Brown Animal Sanatory Institute. This triple part meant overwhelmingly hard work, but it did not stop Brodie's researches, and it was only because each post was so poorly paid that it was necessary. England often treats her scientific sons thus, and it is much to be regretted that a man of such distinction should have been obliged to seek a position and salary worthy of his gifts in a colonial university. It was in 1908 that Brodie accepted the chair of physiology at Toronto, and London's loss was Canada's gain.

Prof. Brodie used to revisit London every long vacation, and during these so-called holidays he was always hard at work at research. It was during this time that his famous work on the kidney was carried out, and his Croonian lecture at the Royal Society dealt with one aspect of his investigations on this subject. Soon after the outbreak of war he became a captain in the Canadian medical service, and in this position undertook valuable research work on questions arising out of the war: such as respiratory effects, and the means of re-educating maimed men to become useful members of society.

As a teacher he was most successful; as a writer he was a little slow, but always sure and lucid; his unpublished manuscripts will be brought to light later; as a personal friend he was loyal, straightforward, and true.

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